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NOTICES FROM THE LICK OBSERVATORY.*

PREPARED BY MEMBERS OF THE STAFF.

THE *LEONIDS* OF 1898.

The meteors from this radiant were again observed this year, continuing the observations of 1897. As it was possible that there might be a considerable display, more attention was paid to them than last year.

The following table shows the results of my 1898 observations:

Date. 1898.	Time.		Interval.	No. of Meteors.	Average per Hour.
Nov. 11.	13 ^h 20 ^m	to 15 ^h 10 ^m	1 ^h 50 ^m	8	4.4
12.	12 55	14 55	2 0	10	5.0
13.	13 0	16 30	3 30	38	10.9
14.	13 38	13 53	0 15	8	43.8
14.	14 24	16 0	1 36	73	
15.	13 15	13 45	0 30	4	8.0
16.	13 37	14 7	0 30	8	14.0
16.	15 2	15 32	0 30	6	

The absence of the Moon during the entire period was very favorable. The nights of the 11th, 12th, 13th, 15th, and 16th were clear during the times of observation, and generally the atmosphere was very transparent. The earlier hours of observation on the 14th were clear, but, later, haze overspread the sky, which became so thick at 16^h as to prevent further observation.

It was expected that the maximum would occur on the 13th, but as will be seen from the foregoing table of results, meteors were most frequent on the 14th, reaching an average of 43.8 per hour during the time of observation—nearly two hours. This average would be considerably increased by taking into account

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those meteors not seen by a single observer. The results are entirely comparable, as they are made under as near identical conditions as possible.

The characteristics of the *Leonids* were clearly brought out: rather slow of motion, strong trains, and bluish-white in color, deepening to decided green in the brightest ones. These features were so marked that it was possible to distinguish meteors from other swarms in this way, and as a matter of fact two such on the 13th were rejected as not being *Leonids*, although they came apparently from the *Leonid* radiant.

On the 11th, 12th, and 13th the meteors were charted on star maps, and as the *Leonids* were not too numerous to prevent those from other radiants being included, all meteors seen within the limits of the map were included. On these nights the *Leonids* were in the minority. Many of those seen were observed to come from the direction of *Gemini*. Not only were the *Leonids* most numerous on the night of the 14th, but the brightest ones of the shower appeared then also. The first (and finest) of two fell at 13^h 46^m 44^s P. S. T., the meteor itself being visible for two or three seconds. It came almost exactly from the radiant, and at its brightest was 30 to 40 times as bright as *Venus*. Its apparent path hardly exceeded 10 degrees. The meteor brightened up rapidly, passing just north of δ *Leonis*, where it exploded, the fragments soon disappearing. Its color at first was the usual bluish-white, but as it brightened the color changed, until at the time of explosion it was of a light but brilliant green. Immediately after the disappearance of the meteor, the debris cloud became very noticeable, and as there was an almost perfect calm, it remained near the same place for fifteen or twenty minutes, its form and brightness changing but little. The general appearance of this cloud to the naked eye was that of a splendid comet with a tail some 3° long, pointing to the northeast. To the eye its color was a dull white, or slightly tinted with pink. About five minutes after, the cloud was examined with the 4-inch CLARK comet-seeker. Its form was still *very sharply* outlined, rather irregular and full of brighter knots. There was a bright secondary branch making an angle of about 60° with the main stream. There was so little disturbance from the wind, that it seemed as if the branch must have been the debris from a fragment of the meteor. The meteor cloud was compared with the Great Nebula in *Andromeda*, and was seen to be very much larger and

brighter than the latter. In the telescope the color was a bright rose-pink.

The head of the cloud immediately after its formation was in α 11^h 10^m and $\delta + 24^\circ$. At 14^h 13^m the same part of the cloud occupied the position α 11^h 0^m and $\delta + 16^\circ$. The cloud was still plainly visible, although much fainter, at 14^h 29^m , 42 minutes after the fall of the meteor.

At 14^h 37^m $18^s \pm 5^s$ another bright *Leonid* fell near the eastern horizon. There was considerable haze there at the time, but even through this it was very brilliant, green in color, and left a bright cloud where it fell. Five minutes after the meteor's fall the cloud was still very distinct. This meteor was several times as bright as *Venus*.

Shortly before the close of our observations on the 13th, an unusually bright meteor was visible close to the southern horizon. Its course was almost vertical, which precluded its being a *Leonid*.

C. D. PERRINE.

November 17, 1898.

THE *LEONID* SHOWER IN 1898.

On the night of November 11th, a three hours' watch for *Leonids* was rewarded by only six, none of them very brilliant. Saturday night, November 12th, the sky was very clear, as on the preceding night, and the north wind, which had made the watchers very uncomfortable on Friday night, had greatly moderated its violence. Forty-one meteors were counted and charted in two hours from 13^h 45^m to 15^h 45^m P. S. T., twenty-four of which were classified as *Leonids*. Many of the others came from the constellation *Gemini*. No unusually bright meteors were noted. Sunday night, November 13th, the sky was somewhat hazy. Sixty-six meteors were charted, of which twenty-seven were counted as *Leonids*. Several of these were bright, but the only unusually brilliant meteor seen was not a *Leonid*. This one—a brilliant green in color—fell almost vertically in the south at about 16^h 25^m P. S. T., but left no smoke-cloud when it burst. The watch was continued for four hours from 12^h 30^m , Monday night, November 14th, the sky was hazy when I began to watch at 13^h 30^m P. S. T., and by 16^h the clouds had gathered too thickly to make further count possible. But in spite of this, the display of *Leonids* was far better than on preceding nights, in point of brilliancy as well as in the numbers of meteors